

How Military Intelligence Personnel Collaborate on a Sense-Making Exercise

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ABSTRACT

Sense-making plays an important role in Intelligence Analysis, but can be difficult to study in situ. Thus, it is common to use training exercises to study this phenomenon. In this paper, an exercise was undertaken by Military Intelligence personnel. The behaviour of groups of analysts is considered in terms the Data / Frame Model of Sense-making. The paper illustrates how Intelligence Analysis need not follow a linear process but often involves parallel and overlapping explorations of data, with multiple frames that might be minimal and sketchy. The use of representations, such as link diagrams, provides a means of externalizing frames and it is suggested that this shifts reasoning from deductive reasoning to abductive reasoning as the exercise progresses.

KEYWORDS

Sense-making; Intelligence Analysis; Representations.

INTRODUCTION

While it is unlikely that there is a single, definitive way of ‘doing’ Intelligence Analysis, there are generic descriptions of how Intelligence Analysis could be performed. For instance, NATO (2008) describes the Intelligence (or Analysis) Cycle in terms of four phases:

- Direction: define objectives for Intelligence Requirements and Requests for Information;
- Collection: gather information by agents or assets;
- Processing: compile and interpret information to produce intelligence product;
- Dissemination: distribute appropriate parts of the intelligence to relevant parties.

Although this implies a flow from collection to dissemination, alternative descriptions emphasize the recursive nature of the analysis process. For example, Elm et al. (2005) define this process in terms of ‘down-collect’ (sample from the available data for material deemed to be ‘on analysis’), ‘conflict and corroboration’ (ensure accurate and robust interpretation of findings, and modify the ‘down-collect’ accordingly), and ‘hypothesis exploration’ (construct coherent narrative to explain the findings, and reflect this narrative back to the ‘conflict and corroboration’ activity). This recursion means that Intelligence Analysis is not linear (Heuer, 1999; Heuer and Pherson, 2010; Roth et al., 2010; Kang and Stasko, 2011). Such recursion is neatly captured by the Data / Frame model of sense-making model (Klein, Moon and Hoffman., 2006a, b).

Data / Frame Model of Sense-making

Central to sense-making in the Data / Frame model is the relationship between the data to which the analyst has access and the different ‘frames’ that can be used to interpret, make sense of, or explain, these data. Klein et al (2006a) point out that, “*When people try to make sense of events, they begin with some perspective, viewpoint, or framework – however minimal. For now, let’s use a metaphor and call this a frame.*” (p. 88, emphasis added).

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Most crucial of all to the Data / Frame model is the suggestion that the relationship between data and frame is both reciprocal and parallel. In other words, a frame could be applied to a set of the data, or a set of the data could suggest a frame. This reciprocity points to the continuous interweaving of activities of exploring data and generating interpretations. What is particularly useful about the notion of a frame is that it need not imply a 'solution' or final 'product' but can serve as a temporary explanatory model of aspects of the data. This accords with the suggestion from Kang and Stasko (2014) that analysis involves the interleaving of processes directed at constructing conceptual models, collecting data, analysing data and producing key findings to share with other people.

While the Intelligence Cycle might begin with 'Direction', this only gives a high-level sense of what the analyst might be looking for. As 'Collection' and 'Processing' progresses, new problem opportunities arise through 'discovery-led refinement' (Attfield and Blandford, 2010). Having said this, at a tactical level, these are usually considered separate activities, e.g., collection via an ISTAR asset overseas could be completed before the analyst can see the results. Indeed, processing at the collection stage (in terms of 'cleaning' of data or in terms of checking for potentially useful data could occur at a low level and then result in material which is passed on to the analyst. Thus, one could read the Data / Frame model in terms of a 'Direction' providing a tightly specified frame (so that the analyst will only collect and process data which are directly relevant to this frame), or in terms of a familiar problem (so the frame could be based on previous experience of similar cases), or in terms of a problem opportunity (so combinations of data would suggest particular frames which could be expanded and explained). The point at issue is not how people use frames but how they define them in the first place (Roth et al., 2010).

METHOD

The study reported in this paper used an exercise developed for a Visual Analytics Summer School 2012 and reported at a previous NDM conference (Baber et al., 2013). Initial analysis was derived from ad hoc observation of group performance and it was felt that a more controlled approach to data collection would be beneficial. This paper presents the approach to data collection and analysis that was developed to study this Exercise.

Objective

The Exercise was designed with the assumption that the correct solution (as detailed in Appendix One) could be arrived at by defining an accurate modus operandi (M.O.) of how a gang in the scenario operated. The M.O. was as follows: a gang uses a yacht to transport drugs from Roskoff (France) to a marina in Exmouth (UK)². The yacht also carries a passenger who puts the drugs into a van hired by the marina's management and drives to a warehouse in Leeds (UK). The drugs are then distributed to drivers in a mini-cab company in Leeds and sold. In order to make the exercise challenging, the data also relate to three other 'stories'.

Procedure

The University of Birmingham ethics protocol was followed (i.e., participants were free to withdraw at any time and all data collected (including images and video) would be anonymized before reporting). Participants were given a briefing, which was intended to simulate the 'Direction' phase of the Intelligence Cycle, and the Exercise concluded with a presentation by each group, which was intended to simulate the 'Dissemination' phase of the Intelligence Cycle. The briefing is given in Appendix Two.

Following the briefing, participants were allocated to groups of 4-6 members³ and then taken to their own incident rooms to complete their investigation. These rooms were equipped with whiteboards, large notepads, pens, post-it notes and paper. Each group was provided with a pack of 49 slides. The pack included nine suspect cards (with picture of the suspect and their correct addresses), together with a combination of telephone logs, harbourmaster logs, maps, business accounts, witness and arrest statements, newspaper articles etc. Figure 1 provides an illustration of the types of information supplied⁴. Each sheet contained several topics, e.g., dates, phone numbers, names, locations etc.

² We should make very clear that the place names Exmouth, Leeds and Roskoff were included in an entirely fictional capacity and that there is no implication that any of these towns, or indeed Exmouth Marina, have been involved or implicated in any of the events in the Exercise.

³ Contemporary approaches to Intelligence Analysis often rely on groups of people working together in 'Fusion' centers (Roberts, 2011; Treverton and Gabbard, 2008). For example, the US Army All-Source Analysis System (ASAS) involves four analysts working together to provide data for a senior analyst. We took this as a template for our study and had people working in teams of 4-6 people.

⁴ A complete pack of materials can be obtained from the lead author on request.

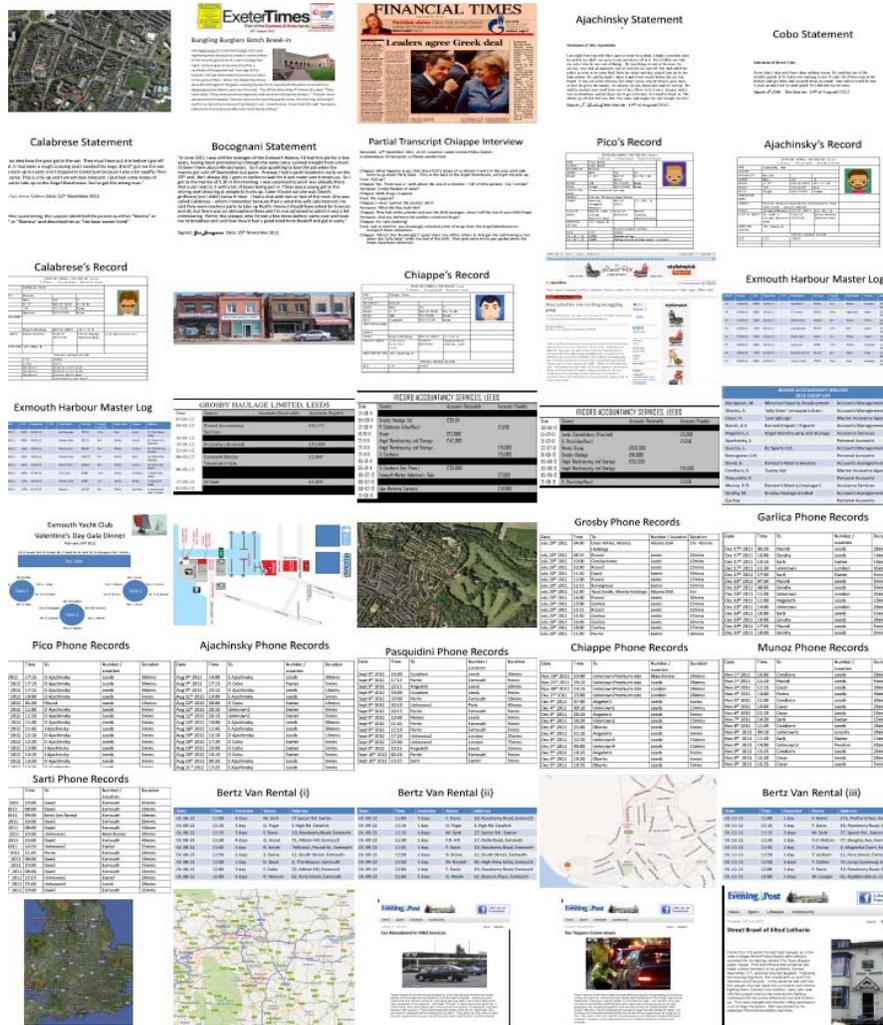


Figure 1 : Information used in the Exercise

Participants

The study involved a workshop with serving British Army Intelligence Analysts, as part of a weekly Intelligence Analysis programme. Sixteen officers and soldiers agreed to be observed during the investigative study. The participants were divided into three groups, with two groups of five and one group of six. Five participants were female and the remainder were male.

Data Collection and Analysis

The analysis involved three forms of data. Each group had a dedicated observer who recorded the activity on the group on an activity sampling sheet every 10 minutes. Each observer, when they were not completing the sampling sheet, took photographs of the diagrams that the groups were making, or of group activity, and made contemporaneous notes of the group discussions. At the end of the exercise, each group presented its findings.

RESULTS AND ANALYSIS

In these data, counts of activity (related to number of topics discussed, number of actions performed etc. during the sampling window) are presented in the form of graphs to provide a convenient means of comparing groups. Deeper analysis is provided in the form of extracts from qualitative analysis of specific events in the exercise.

Activity Sampling Results

The information sheets contained information which can be classified in terms of Suspect, Date / Time, Locations (Exeter, Roskoff, Leeds, Exmouth), Vehicle (yacht, van) Action (payment, social activity, business, crime). This classification defines the set of topics that groups discussed. In the activity sampling, each mention of a topic was counted in the sampling period. Thus, if the group said ‘Condiere owns the yacht called Sunny Jim’, we would count 1 for ‘suspect – Condiere’ and 1 for ‘vehicle – yacht’.

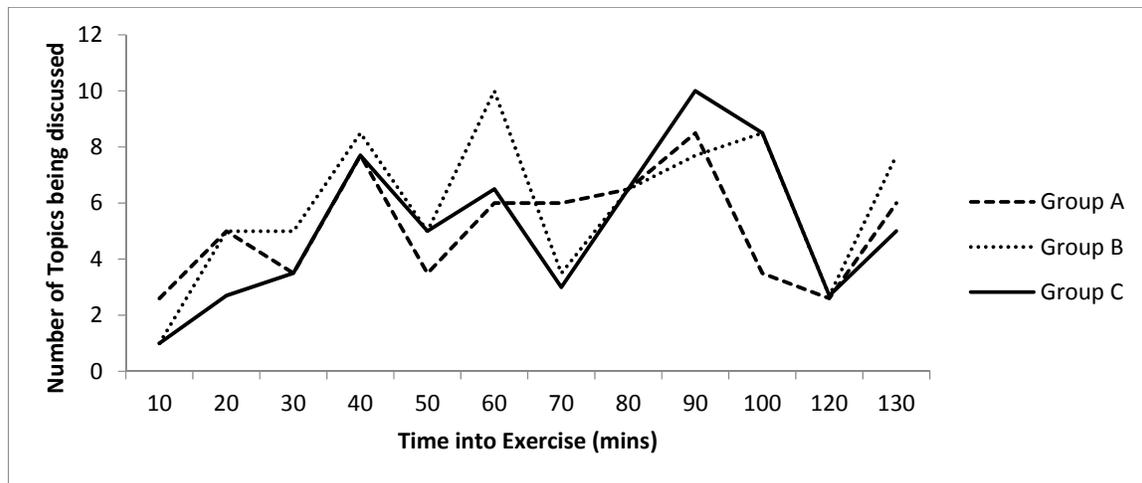


Figure 2 : Number of topics discussed over time

Figure 2 plots the number of topics mentioned at each sampling period. Overall, the average number of topics is consistent across the groups, i.e., A = 6 (± 3), B = 5 (± 4) and C = 5 (± 3), which are similar to the results of three of the groups in version one.

Processes of Sense-making

From the activity sampling data, it is possible that the groups tended to alternate between broad (several topics) and narrow (few topics), which suggests movement from linking to the development of rules. To explore these forms of interpretation, the following section presents extracts of discussion between participants. The discussions are verbatim records of participants’ statements. Each extract is identified by group {A,B,C} and speaker {a,b,c,d,e}.

SEEKING A FRAME

Group B (5 participants) began by discussing the Angel warehouse and then split into two sub-groups. One subgroup searched for more information about the warehouse, while the other subgroup (consisting of Participants Bb and Be) developed a social network diagram on the whiteboard. Thus, Group B framed the task as a social network problem. They identified a possible American connection (presumably in terms of the purchase of the marina by a US company in a deal brokered by Grosby).

DEVELOPING A FRAME

Group C argued between arresting Sarti and arresting Pasquidini. In particular, group C discuss the role of Pasquidini and present inferences that feature him as a shadowy figure (Cb “the anonymous Frenchman”) who Ca notes is “connected...He has links”, and Cd observes “He’s been calling all over the joint”. Against this proposal Cb is concerned “All we have is the phone records” which raises the issue of what would constitute evidence to support the arrest of an individual in this exercise. This discussion leads to the development of a rule proposed by Ca “We need to take out the source in France to bring down the whole network.”

COMPARING, ELABORATING AND QUESTIONING FRAMES

In this exercise, the groups would regularly (every 20 minutes or so) collect around the representation that they were creating and run through their analysis. At one level, this could be seen as rehearsal of their final presentation. At a deeper level, this provides an opportunity to question the story. In other words, the groups were elaborating and questioning the frames they were using (i.e., ‘conflict and corroboration’ and ‘hypothesis exploration’ (Elm et al., 2005), and the rehearsals could be seen as ways of testing the narrative of their analysis.

Comparison of Solutions

All three groups identified Sarti (3/3) as a prime suspect (because she was central to so much of the exercise) and all three teams named Pasquidini (3/3). Two of the groups proposed that Pasquidini should be arrested in France, suspecting his involvement in supplying the drugs and loading them on to the yacht. Groups also discussed Pico / Cobo (2/3), as a driver of the van, and mentioned Calabrese (2/3) in support of this proposal; Calabrese was Ricord’s chauffeur and had been arrested driving the van, and now Pico / Cobo was Ricord’s chauffeur so looked suspicious. All three groups used the Harbour Logs (3/3) and Accounts (3/3) to provide evidence of who was linked to whom and when events occurred, with the phone records (2/3) supplementing the links.

DISCUSSION

The exercise was designed on the an assumption that the ‘best’ way to reach the correct assessment was to identify the modus operandi (M.O.) of the gang and then look for information as to when this M.O. was likely to be applied. However, while there are instances where the groups described the M.O., this did not seem to be the primary focus on their analysis; rather, data were combined into sets, or frames, and group discussion seemed to focus on these frames.

Using Frames

Frames begin in a sketchy (minimal) manner, either through the linking of data in representations or through the linking of concepts in response to questions. This might be a function of the nature of the information provided for the exercise, with all groups beginning their processing with the sorting of sheets into piles. An interesting point to note here is when, or if, the piles of information sheets became ‘frames’.

The groups not only sought links between sampled information, but also developed their hypotheses through testing them. Thus, group C not only raised hypotheses about Pasquidini, Sarti and Calabrese but also challenged these hypotheses in their discussions. This suggests that these groups were not only engaging in the ‘down-collecting of material but also in ‘conflict and corroboration’. Further, the observation that all the groups would rehearse their presentation at intervals during the Exercise suggests that they recognised the value of ‘hypothesis exploration’ as a core part of their analytical work.

In terms of the Data/ Frame model of sense-making, this paper offers some insight into the dynamics of the process of sense-making in teams. The observational data suggest that teams prefer to work with a small number of pieces of information (i.e., a mean of 5 pieces). Further, the groups tend to move between broad and shallow and deep and narrow search (focusing on specific frames, but, generally working with more than one frame at any one time). Previous work had shown that the less experienced analysts might have been either unable to generate an appropriate frame (being swamped by data) or who might have stuck with a particular frame even when it is not appropriate to the current set of data (Baber et al., 2013). This implies that differences in sense-making of experienced and inexperienced analysts are not solely a matter of knowledge of the domain but relate to the manner in which evidence is selected and processed, and hypotheses and frames employed.

The extracts of team discussions suggest that, even when teams focus on a frame, their attention is drawn to other data and the analysis moves between several frames in short succession. This suggests that traversal of the Data / Frame model is faster than one might expect. In other words, in this Exercise, teams seem to move through the Data / Frame cycle quickly, with consideration of several frames, rather than taking a single frame and processing this. This implies that the Exercise resulted in an abductive approach to reasoning, in which the data were explored and different explanations generated, rather than a hypothetico-deductive approach. While we would not claim that this represents all forms of Intelligence Analysis, it is interesting that this cyclical approach is very different from the linear approaches implied by Pirolli and Card (2006) or Heuer (1999); though it is difficult to assess if these were proposed as normative models, or as realistic models of how people *actually* work. What we observed in this study was that, while people operate using ‘competing hypotheses’, these tended to be articulated as loose, imprecise statements rather than as objectively grounded comparisons.

Creating and Using Artefacts as Representations

Artefacts are a way of externalizing a frame in which sets of data can be combined. The representations either focused on the grouping of people (through link or social network diagrams) or events (through timelines), or a combination of these. Initially these were a means of organising data. However, as the Exercise developed, the representations became the focus of the final presentation. This meant that, rather than creating representations to serve as aide memoire for their own discussions (as inexperienced groups did in Baber et al., 2013), the groups were creating representations for an audience, i.e., their Commanding Officer to whom they would give their presentation. This suggests that the activity was primarily a hypothesis creation activity in which relations between topics and resulting inferences could be used to create hypotheses for further investigation.

As de Vries and Masclet (2013) point out, collaboration is often based on minimal representations. In this Exercise, representations created in collaborative activity are not merely diagrams showing data; rather, they are records of the discussion and thought-processes of the groups. This means that, in order to understand the content of the representations, it is often necessary for someone from outside the group to have an explanation of the assumptions, ideas and background knowledge that inform these representations. In other words, the role of representations is often to capture ‘local’ discussion rather than to create a more ‘global’ view. In order to develop from this local-to-global view of the information, it is important to have some notion of audience. Intelligence Analysts often talk of ‘product’ as the output of their activity. What we note here is that ‘product’ can look much the same whether it is produced by experienced or inexperienced analysts, and the primary difference is not the ‘product’ per se so much as the understanding of who will use that product, how they will

interpret the product, and what aspects of the product they will find convincing. This distinction supports the advice offered by Heuer (1999).

Conclusions

The study in this paper supports the observation that Intelligence Analysis is not a linear, orderly process (see also Elm et al., 2005; Kang and Stasko, 2011; Roth et al., 2010). Even with so simple a set of evidence, we could observe behaviour that was parallel (with several group members working on different lines of enquiry), disjointed (with group members pursuing contradictory ‘frames’, e.g., arrest Sarti or Pico, or Sarti or Pasquidini), and recursive (with groups dismissing a frame and then reintroducing it, e.g., dismissing the abandoned car and then considering that it was used as the drug transport vehicle). This suggests that such behaviour is likely to be a characteristic of this type of activity. From this, it is apparent that the activity is primarily one in which small sets of data are combined and explained.

From the use of representations, it is apparent that experience dictates the manner in which people construct, use and share representations. This suggests that the design of “sense-making support systems” (Weick and Meader, 1993) should not focus simply on ways to support the construction of diagrams and other forms of representation, but also needs to consider the manner in which these representations are to be used. For example, tools which support the collation of information to help identify links between pieces of information might help with ‘down-collection’ of data but does not provide support for ‘conflict and corroboration’ or for ‘hypothesis exploration’.

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Appendix One : Solution to Exercise

1. The Solution is to arrest Pasquidini (the passenger on the yacht, as outlined in the M.O. above). The puzzle is to place Pasquidini in Exmouth and to see him as the van driver. There is no direct evidence to this effect (which is why the Exercise is challenging). However, the combination of M.O. and evidence from today and yesterday should help the groups narrow down their set of suspects and realise that the yacht's passenger is the van driver and that Pasquidini possibly travelled from France.
2. There are three people who are dubious but who have insufficient information to justify arrests:
 - a. Muriel Grosby has been involved in the deal to buy the marina and has a wide range of highly suspicious transactions in her business accounts. She also owns the mini-cab firm which is dealing the drugs. On the other hand, she is involved in charitable events with the Marina and with making donations to it. The accounts and client list of Ricord Accountancy Services link many of the characters together suspiciously – but not in sufficient detail to clearly indicate nefarious activity.
 - b. Martina Sarti hires the vans which are used for transporting the drugs – but it is likely that she hires vans on a regular basis for people coming into the marina and not specifically for the smuggling operation. She has received money from Grosby but it is not obvious why this is suspicious, given their relationship with the marina.
 - c. A petty criminal (Cobo a.k.a Pico) who comes from Leeds, is living next to Martina Sarti (although it is likely that she is spending most of her time in Exmouth with David, the marina manager), and is being paid as a chauffeur by the accountant Ricord.

In order to arrive at the solution, one approach would begin with the arrest of Calabrese, who (as pointed out in the briefing was sentenced on 14th June 2012). The newspaper article detailing Calabrese's sentencing notes that he was arrested in November 2011. Two statements dating from November 2011 (one from Calabrese and one from Bocognani, the former manager of the Marina) suggest that the gang's M.O. is to ship drugs from Roskoff on a yacht skippered by Perrin, to arrive at Exmouth in the early hours and for the drugs to be moved by van to the Angel Warehouse in Leeds. A record of van hire shows that Sarti hired a van in early November 2011. A review of other van hire logs shows that Sarti hired a van in August 2012 and hired a van yesterday (9th September 2012). The Marina log shows that the only yacht due in today is the 'Sunny Jim', owned by Condiere. The other evidence that corresponds to 'today' is the phone logs of Pasquidini, who calls Condiere, Perrin, Angelletti, Munoz and Sarti. Pasquidini's 'suspect card' shows that he lives in Roskoff.

Appendix Two: Briefing given to all participants

"Muriel Grosby is a businesswoman who lives in Leeds and runs a road haulage and mini-cab firm. While she has no criminal convictions, local police have long been suspicious of her acquaintances and believe that she has links with criminal activity, particularly relating to drug smuggling and people trafficking. A known contact of Grosby, called Calabrese, was sentenced, on 14th June, to 9 years for drug smuggling. Intelligence suggests that there is likely to be a shipment of class A drugs being delivered to a port in the South-West of England in the next few weeks. Given resource and personnel constraints, it is not possible to follow every suspect so you need to determine who should be arrested and where the best place might be to make such arrests.

Following your investigation, you will give a presentation on your findings. The presentation will include:

1. *Name of individual, or individuals, to target as Suspects.*
2. *The FIVE pieces of evidence that best support your proposal to 1.*
3. *Location of the arrest or arrests.*

In order to make this exercise easier, you will select suspects from a set of nine people:

- *Muriel Grosby, who I have already described;*
- *Jennifer Garlica who is Grosby's sister-in-law and whose husband was killed last year in what looks like a gangland hit;*
- *Vanessa Munoz who is the assistant manager of Exmouth Marina;*
- *Martina Sarti who works at the marina and is the girlfriend of the marina manager (Xavier David);*
- *Pierre Pasquidini who lives in Roskoff and travels regularly to the UK;*
- *Kenny Chiappe who drives a mini-cab in Leeds;*
- *Jake Ajachinsky who is a petty criminal;*
- *David Pico who is Jake's best friend, is also a petty criminal and has a tempestuous on-off relationship with Jake's twin sister, Denise Ajachinsky, who is also a suspect.*

For this Exercise, 'today's' date is September 10th 2012 (this will help you make sense of the dates and times on the documents you have)."